

Marine Mollusca of Eastern Australia

1. The Genus CYMBIOLACCA Iredale (Family Volutidae).

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(Plate xlv and Text-figure 1)

This paper is the first of a series which is planned to review the marine mollusca of eastern Australia. Each paper will take the form of a revision of a genus or family dealing with all the species from this coast as completely as possible, and with species from other areas when necessary. It is hoped that the papers will serve as an aid to identification by amateur collectors as well as to advance taxonomic knowledge of the groups under review.

During recent months a number of unusual specimens of volutes have been forwarded to the Australian Museum for identification. The difficulty of identifying some forms has led to a general revision of the taxonomy of the group of species allied to *Cymbiolacca complexa* Iredale 1924. The latter was a substitute name for *Voluta punctata* Swainson 1823, which is preoccupied by *Voluta punctata* Allan 1818, but the species is still widely referred to under the invalid name *V. punctata*. The other species which are dealt with here have appeared in previous lists as *Cymbiola pulchra* Sowerby 1825, *Cymbiola* (or *Aulica*) *wisemani* Brazier 1868, and *Aulicina perryi* Ostergaard and Summers 1957. Recently (McMichael, 1958) I have added *Cymbiolacca pulchra woolacottae* McMichael to the list of names, and in the following review it is proposed to discuss the geographic variation of these species and to consider their relationships.

The species have been allotted to several genera at various times, including *Voluta*, *Scaphella*, *Cymbiola*, *Aulica*, *Aulicina*, and *Cymbiolacca*. There has been a good deal of confusion over the years as to the correct use of a number of generic names in this group (Volutidae), so they are discussed briefly below. Much of the confusion is due to ignorance of the rules of nomenclature and to failure to consult the original literature. After a good deal of searching the following appear to be the correct references to the several genera, together with their type species. (In nearly every case, there are several later, incorrect usages of the generic names based on incorrect type species, but these are not detailed here.)

Voluta Linne, 1758, *Systema Naturae*, Ed. 10, pp. 645 & 729, Gen. No. 287.

Type Species: *Voluta musica* Linne, 1758, *Systema Naturae*, Ed. 10, p. 733, Vermes Testacea Sp. No. 370. By Subsequent Designation, Montfort, 1810, *Conch. Syst.*, 2: 551.

Cymbiola Swainson, 1831, *Zoological Illustrations*, 2nd Ser., Vol. 3, pl. 83. (This reference can also be written: 2nd Ser., Vol. 2, Pt. 18, pl. 83, depending on whether the work is bound as issued or as suggested by Swainson.)

Type Species: *Voluta cymbiola* Dillwyn, 1817, *Recent Shells*, 1: 576. By Absolute Tautonymy.

Scaphella Swainson, 1832, *Zoological Illustrations*, 2nd Ser., Vol. 3, pl. 87. (Or alternatively, 2nd Ser., Vol. 2, Pt. 19, pl. 87.) Type Species: *Voluta junonia* Shaw, 1808, *Nat. Miscellany*, 19, pl. 815. By Subsequent Designation, Hermannsen, 1848, *Indices Generum Malacozoorum*, 2: 423. (Clench, 1946, attributes to Gray, 1847, *P. Zool. Soc. London*, p. 141, the designation of *V. junonia* as type of *Scaphella*, but it is doubtful whether this is a valid designation. Hermannsen is quite unambiguous, and in either case *V. junonia* emerges as type species of *Scaphella*. The various "Types" of Swainson (1840) cannot be accepted as valid type species designations.)

Aulica Gray, 1847, *P. Zool. Soc. London* 1847: 141. Type Species: *Voluta aulica* Sowerby, 1825, *Cat. Tankerville*, p. 81, Appendix p. 29, pl. 3. By Monotypy.

Scapha Gray, 1847, *P. Zool. Soc. London* 1847: 141. Type Species: *Voluta vespertilio* Linne, 1758, *Systema Naturae*, Ed. 10, p. 733, Vermes Testacea Sp. No. 371. By Original Designation. (This name is preoccupied by *Scapha* Molchulsky, 1845, in Coleoptera. *Aulicina* Rovereto is an available junior synonym.)

Ausoba H. & A. Adams, 1858, *Gen. Recent Moll.*, 1: 160. Type Species: *Voluta cymbiola* Sowerby, 1825 (= *V. cymbiola* Dillwyn 1817) by Monotypy. (This generic name is therefore a junior objective synonym of *Cymbiola* Swainson, 1831.)

Vespertilio Klein, 1753 (often cited in connection with this group), is pre-Linnean, and the name was used by Linne (1758) for a genus of Bats. The name was reintroduced into mollusc nomenclature by Moerch, 1852, for *Voluta vespertilio* Linne, but, of course, is preoccupied. It was apparently replaced by

Aulicina Rovereto, 1899, *Atti Soc. Lingustica Genoa*, 10: 103, a new name for *Vespertilio* Moerch, not *Vespertilio* Linne. This journal is not available in Australia and I have been unable to check it. It is a junior objective synonym of *Scapha* Gray, which is preoccupied.

Cymbiolacca Iredale, 1929, *Rec. Aust. Mus.*, 17: 181. Type Species: *Cymbiola complexa* Iredale, 1924, *P. Linn. Soc. New South Wales*, 49: 183 & 258. By Original Designation.

Volutocorona Pilsbry and Olsson, 1954, *Bull. Amer. Paleont.*, 35, No. 152: 25. Type Species: *Voluta imperialis* Lamarck, 1811 (= *V. imperialis* Solander, 1786, *Cat. Portland Mus.*, p. 183.)

The only valid generic names which have been used, therefore, are *Voluta* Linne, *Cymbiola* Swainson, *Scaphella* Swainson, *Aulica* Gray, *Aulicina* Rovereto, *Cymbiolacca* Iredale, and *Volutocorona* Pilsbry and Olsson. Of these, *Voluta* and *Scaphella* are restricted to Atlantic genera, which are quite distinctive from the species considered here. Examination of the several species of Indo-Pacific volutes which are usually listed as *Aulica* or *Cymbiola* and comparison with the *complexa-pulchra-wisemani-perryi* series reveals that at least three groups are separable.

Cymbiola cymbiola (Dillwyn) (together with *C. coronata* Sowerby and possibly *C. sophiae* Brazier) differs from all other species in shape, in its low spire, and in the nature of the spines, which are high up on the whorls and rather delicate. The protoconch is large, almost planate, and in this it resembles the species related to *Aulica aulica*. It seems best to restrict *Cymbiola* to these species and to retain the group as generically distinct from *Aulica*.

Aulica aulica (Sowerby) appears to be a member of a complex of forms which have received many names and are all fairly closely related. These forms are nearly all rather heavy-shelled, without sharp spines, but sometimes with knobs or blunt spines, growing to a fairly large size and with heavy planate apices. Some of the named forms included in this complex are as follows: *aulica* Sowerby 1825; *rutila* Broderip 1826; *norissi* Gray 1838; *piperita* Sowerby 1844; *innexa* Reeve 1849; *cathcartiae* Reeve 1856; *ruckeri* Crosse 1867; *macgillivrayi* Cox 1873; *ceraunia* Crosse 1880; and related to these are such species as *rossiniana*, *flavicans*, *tissotiana*, *mariaemma*, *quaesita*, and *kellneri*. The generic name *Aulica* can be applied to all the forms listed above. *Aulicina* proposed for *vespertilio* Linne probably represents a subgenus of *Aulica* and would include *nivosa*, *oblita*, *irvinae* and other spinose species.

Cymbiolacca Iredale was introduced as a subgenus of *Cymbiola* on the grounds that the type species (*C. complexa* Iredale) did not possess the planate protoconch which true *Cymbiola* has. Iredale did not include *pulchra* and *wisemani* in *Cymbiolacca*, but there is no doubt that the three species are closely related, and they are sufficiently distinct in form from *Cymbiola* and *Aulica* to be regarded as a distinct genus. These species all possess a comparatively small conical apex, consisting of three or four whorls bearing white radial ridges or nodules, spaced about one mm. apart. The apical whorls of *Aulica* are similarly ridged, but in that genus the protoconch is planate or nearly so, and the shells

are mostly heavy, with large knob-like spines. The shells of *Cymbiolacca* are small and light, and the spines are quite sharp, or developed only as small knobs, or lacking altogether.

The three species here included in *Cymbiolacca* have a basically similar colour pattern. This pattern takes the form of white triangular markings and brown spots of varying size on an orange, yellow, pink, or red background. The variation in this pattern, particularly in the distribution of the brown spots, serves for the separation of the species.

The radula of *Cymbiolacca* has not previously been examined. It has now been studied in two species (*C. complexa* and *C. pulchra*) and proves to be rather similar to that previously described for *Aulica vespertilio* (Linne) and *Cymbiola* (?) *sophiae* (Brazier) (Cooke 1922, Pace 1902). It consists of a uniseriate ribbon, the rachidian teeth tricuspid, the cusps nearly equal in length, with the base deeply arched.

The species are treated systematically below.

Family VOLUTIDAE Fleming 1822.

Subfamily CYMBIINAE H. & A. Adams 1853.

Genus CYMBIOLACCA Iredale 1929.

Following the systematic arrangement of the Volutidae as proposed by Pilsbry and Olsson (1954), this genus is placed in the subfamily Cymbiinae, tribe Meloidea, next to *Aulica* Gray, from which it differs by its small, conical ribbed protoconch. The radula teeth are similar to those of *Aulica* but the bases of the teeth are more deeply arched in *Cymbiolacca*.

Cymbiolacca complexa (Iredale)

(Pl. xlv, figs. 1-3)

Cymbiola complexa Iredale, 1924, *P. Linn. Soc. New South Wales*, 49: 183 & 258. New name for *Voluta punctata* Swainson 1823, *Zoological Illustrations*, (1), 3: pl. 161; not *Voluta punctata* Allan 1818.

Voluta punctata Sowerby, 1844, *Thes. Conch.*, 1: 198, pl. 53, figs. 89 & 90.

Voluta punctata Reeve, 1849, *Conch. Icon.*, 6: *Voluta*, pl. 21, sp. & fig. 52.

Voluta punctata Cox, 1871, *J. de Conch.*, 19: 77, pl. 5, fig. 2.

Voluta punctata Cox, 1871, *P. Zool. Soc. London 1871*: 324, pl. 34, fig. 6.

Cymbiolacca complexa Iredale, 1929, *Rec. Australian Mus.*, 17: 181.

Cymbiola complexa Allan, 1950, *Australian Shells*, p. 168, pl. 21, fig. 6.

Remarks:

This rare and beautiful species was known for more than a century under the preoccupied name *Voluta punctata*. The species was described by Swainson from an unknown locality and from a single beach-worn specimen. It was many years later that Cox confirmed the locality as New South Wales with the discovery of shells at Broken Bay, and Brazier also found the species about the same time near the Bellenger River. Cox (1871) figured an adult shell, and recently many perfect specimens have been found, while the range of the species is now known to extend from Bulli, south of Sydney, to north of Bundaberg, Queensland. Over this range a series of populations occurs, showing regular clinal variation, with a sharp break at Fraser Island, Queensland. Around Sydney, the shells are fairly small, the body-whorl only slightly shouldered and sometimes without any knobs or spines. Further north, about Coff's Harbour, the shells are still quite small, but nearly always have a series of knobs or short blunt spines running around the top of the body whorl, thus giving the shells a definite shoulder. Shells from south Queensland are larger, definitely shouldered and with a series of short, moderately sharp spines. The proportions are the same as those of the southern shells, but the colouring is richer. Typical specimens from off Noosa Heads and Manning River Heads are figured on Plate xlv, figs. 1 & 2.

Shells of this type occur as far north as the southern shore of Fraser Island, but north of that island in Hervey Bay is found a rather distinct population,

with more elongate shells and an overall darker coloration. This population is apparently isolated to some extent in Hervey Bay, and is named below as a new subspecies.

Description:

Shells small to medium sized, the maximum length about 80 mm., though shells about 40 to 50 mm. are commonly found. The maximum width about 46% to 50% of the maximum length. Spire short to moderately long, body whorl large, more or less shouldered, the shoulder sometimes bearing small knobs or short spines, which are fairly closely appressed to the body whorl. Aperture large, gaping; columellar plaits four. Shell yellow to orange-red, covered with numerous small, white, or cream triangular markings about one mm. in height, and also with minute red or brown spots, usually less than one mm. in diameter, which are randomly distributed over the shell surface. In northern populations the spots are a little larger, darker, and more numerous, and there are blotches of reddish-brown forming two incomplete and indistinct bands running around the shell. Below the suture there is a band of vertical, closely spaced, dark-brown lines running to a point half-way between the suture and the spines.

In the most northern population known, from Hervey Bay, the shell is distinctly narrower, the maximum width about 43% to 45% of the maximum length, with the spots larger, up to 3 or 4 mm. in length, elongated vertically, and darker, but still distributed randomly over the shell surface. The blotches of reddish brown have fused into two dark, almost continuous brown bands, and the shells have a much darker appearance in general. This population is here named as a new subspecies, *Cymbiolacca complexa neilseni*, after Mr. Thomas Neilsen, who first brought this form to my notice, and the type is figured on Plate xlv, fig. 3. A specimen agreeing with this race is reported to have been taken at Princess Charlotte Bay, North Queensland, and another from Tweed Heads, N.S.W., but I consider these to be erroneous localities.

The radular teeth are tricuspid, the central cusp longest, blade-like, the lateral cusps slightly shorter, the base deeply arched; the maximum width of each tooth 0.18 mm., the maximum length 0.20 mm. (Text fig. 1A.) The number of teeth 76 plus nascents.

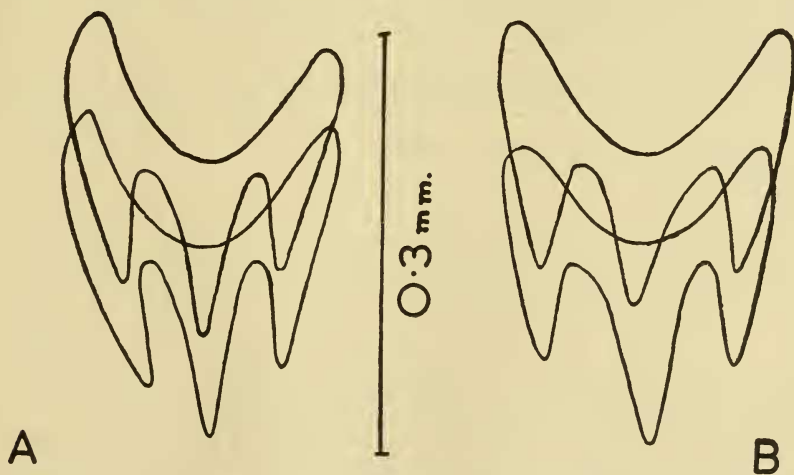


Figure 1.—Radular teeth of (A) *Cymbiolacca complexa neilseni*, and (B) *Cymbiolacca pulchra woolacottae*.

The animal of *C. complexa neilseni* is creamish-white, covered with reddish blotches, formed of numerous wrinkly red lines. The head is small, foot large, siphon elongate.

Types:

The holotype of *Cymbiolacca complexa complexa* Iredale is also the holotype of *Voluta punctata* Swainson, and should be in the British Museum. The type locality of the nominate race may be restricted to Broken Bay, N.S.W. The holotype of *C. complexa neilseni* is in the Australian Museum, No. C.62297, and was presented by Mrs. J. A. Grigg, of Cairns, Queensland. Its dimensions are: Length 71 mm., maximum width 29 mm., apertural height 48 mm. A paratype in the Australian Museum, No. C.62232, was presented by Mr. T. Neilsen. An additional paratype, from which the radula was taken, is in the National Museum of Victoria, No. F.18259. The type locality of *C. complexa neilseni* is 30 miles off Burnett Heads, Hervey Bay, Queensland, 10 fathoms.

Records:

C. complexa complexa: Bulli, N.S.W. (A.M.), Collaroy Beach, N.S.W. (A.M., P. Colman), Broken Bay, N.S.W. (A.M., N.M.V.), off Manning River Heads, N.S.W. (A.M.), Bellenger River, N.S.W. (A.M.), Coff's Harbour, N.S.W. (Mrs. A. R. Bowman), off Wooli, N.S.W. (Mrs. J. A. Grigg), Angowrie, N.S.W. (A.M., Miss G. Thornley), Evan's Head, N.S.W. (T. Garrard), Southport, Qld. (P. Goadby), Stradbroke Island, Qld. (A.M.), Caloundra, Qld. (A.M.), north of Noosa Heads, Qld. (A.M.), Wide Bay, off Fraser Island, Qld. (A.M.), Tin Can Bay, Qld. (T. Garrard, P. Goadby).

C. complexa neilseni: Off Bundaberg, Qld. (A.M., N.M.V.), Elliott Head, near Bundaberg, Qld. (P. Goadby), off Burnett Heads, Hervey Bay, Qld. (P. Goadby, A.M., Mrs. J. A. Grigg), Uranang, Qld. (P. Goadby).

Habitat:

Usually taken by trawling in shallow water (about 5-30 fathoms) along the continental shelf; often washed up dead and broken after storms.

Cymbiolacca pulchra (Sowerby).

(Pl. xlv, figs. 4-6.)

Voluta pulchra Sowerby, 1825, *Cat. Tankerville*, App. p. 28, pl. 4, fig. 2.

Voluta pulchra Reeve, 1849, *Conch. Icon.*, 6: *Voluta*, pl. 21, sp. & figs. 54 a, b.

Voluta (Scapha) pulchra Angas, 1864, *P. Zool. Soc. London* 1864: 51.

Voluta pulchra Tryon, 1882, *Man. of Conch.*, 4: 86, pl. 25, fig. 50.

Aulica pulchra pulchra Maxwell Smith, 1942, *A Review of the Volutidae*, p. 40, pl. 18, fig. 124.

Cymbiola pulchra Allan, 1950, *Australian Shells*, p. 167, pl. 25, fig. 4.

Cymbiolacca pulchra pulchra McMichael, 1958, *P. Roy. Zool. Soc. N.S.W.* 1956-57:149, figs. 3-6.

Cymbiolacca pulchra woolacottae McMichael, 1958, *P. Roy. Zool. Soc. N.S.W.* 1956-57:149-150, figs. 1-2.

Remarks:

I have recently discussed the identity of *Voluta pulchra* Sowerby, and considered it to be a polytypic species, with a race occurring on the coast of Queensland about the Tropic of Capricorn, and an off-shore island race inhabiting the Capricorn and Bunker Groups and Lady Elliott Island. For many years Heron Island was considered to be the type locality of *C. pulchra*, but the type must have been collected by Cook's party at either Bustard Bay or Thirsty Sound. The holotype of *C. pulchra* in the British Museum agrees exactly with the figure given by Sowerby and copied in my recent paper, and represents the coastal form. The nominate race was therefore considered to be the coastal race, and the island race was named *C. pulchra woolacottae* as above.

The study of a series of specimens recently trawled in the waters around the Capricorn Group and the Swains Reefs, Queensland, suggests that the situation is not so straightforward as previously thought. All the deepwater material agrees in form and number of spots with the coastal shells, though many shells are of an overall pinkish coloration; specimens of this type are

occasionally washed up as dead shells on the coral cays of the Capricorn Group. Therefore *C. pulchra woolacottae* cannot be considered a simple geographic race of *pulchra* but appears to be a coral cay form. This situation cannot be expressed with much clarity in a trinomial nomenclatural system, but it seems best to retain *wolacottae* as a racial name for the coral cay populations, which should be considered as polytopic or ecological subspecies. Just what the breeding relationship between the two forms is remains in doubt. It seems likely that there would be a certain amount of gene flow between the cay populations and those from deeper water, and, as previously stated, shells from Bustard Head are to some extent intermediate, while North-West Islet shells are in many ways similar to the true *pulchra*, being more elongate and with more numerous spots than Heron Island shells. It may eventually prove necessary to resume the name *pulchra* for all the shells from this area rather than attempt the recognition of geographic races which are in fact ecotypes. It remains possible that secondary hybridisation following initial isolation accounts for some of the problems in this species.

There is a good deal of variation between the populations of coral cay shells from different islands; if Heron Island shells be considered typical, North-West Islet shells are more elongate and lighter coloured, with numerous spots, while Fairfax Island and Lady Elliott Island shells are large, almost white and with few, very large spots. Meanwhile more complete knowledge of dispersal and the distribution of the various populations is necessary. A typical coast specimen from South Keppel Island is figured on Pl. xlv, fig. 4, and a typical Heron Island shell on Pl. xlv, fig. 5. The holotype of *C. pulchra woolacottae* is figured on Pl. xlv, fig. 6.

Description:

Shells small to medium sized, the maximum length about 90 mm., the maximum width from 46% to 52% of the maximum length; the coastal and deepwater forms more elongate than coral cay populations. Spire short to moderately long, body whorl large, distinctly shouldered, and bearing short, sharp, prominent spines which are appressed to the shell in coastal shells but stand out noticeably in island populations. Shell creamish-pink to orange, sometimes blood red or yellowish, covered with numerous white triangular markings, which are small in typical *pulchra*, not exceeding 3 mm. across, but larger in island shells, from 5 to 10 mm. Three more or less distinct pinkish bands circle the shell, one immediately below the spines, one half-way down the body whorl, and one immediately above the columellar callus. The bands marked with dark brown to black spots, small (not exceeding 2 mm. in diameter) and numerous in coastal shells, but larger and elongated vertically (up to 4 mm. long) in the island race. The dark spots are considerably less numerous in the island race, sometimes almost lacking.

The radula teeth of *C. pulchra woolacottae* are tricuspid, the central cusp a little longer than the lateral cusps, broader than those of *C. complexa neilseni*, and the base not so deeply arched; the teeth are similar in size to *C. pulchra neilseni*, the maximum width 0.2 mm., the maximum length 0.2 mm., the number of teeth 73 plus nascent. (Text fig. 1B.)

The animal is very brightly coloured with deep red stripes and patches on a cream background. The foot is broad, the siphon elongate, the proboscis and tentacles quite large.

Types:

The holotype of *Voluta pulchra* Sowerby is in the British Museum, No. 1957.10.10.1. The type locality of the nominate race is here restricted to Bustard Bay, Queensland. The holotype of *C. pulchra woolacottae* McMichael is in the Australian Museum, No. C.62264, from Heron Island, Queensland, collected by Miss E. Pope, June, 1951. Paratypes are from Heron Island (C.62265), Masthead Island (C.18942), North-West Islet (C.62266), and Lady Elliott Island (C.37531). The radula here figured was taken from a specimen in the Australian Museum (C.62303) from Wistari Reef.

Records:

C. pulchra pulchra: Round Hill Head (P. Goadby), Bustard Head (Mrs. A. R. Bowman, Miss G. Thornley, Mrs. J. Kerslake, Mrs. J. A. Grigg, Mrs. W. Rooke, A.M.), Seal Rocks, Port Curtis (A.M.), Facing Island, Port Curtis (A.M.), Yeppoon (Mrs. A. R. Bowman, Mrs. J. Kerslake, P. Goadby, A.M.), Humpy Island, S. end of Keppel Island (Mrs. A. R. Bowman), South Keppel Island (A.M.), North Keppel Island (A.M., P. Goadby, Mrs. J. Kerslake, A. J. Marsh), Pearl Bay, 80 m. N. of Yeppoon (Mrs. A. R. Bowman), off Tryon Is., off Heron Is., off North-West Is., off Swains Reefs, off Masthead Is. (P. Goadby), off Wistari Reef (A.M.), all in Queensland.

C. pulchra woolacottae: Heron Island (A.M., P. Goadby, N.M.V., P. Colman), North-West Islet (A.M., Mrs. M. Bowman, Mrs. J. Kerslake, P. Goadby), Wistari Reef (A.M., P. Goadby), Fairfax Island, Bunker Group (P. Goadby), Lady Elliott Island (A.M., N.M.V.), Queensland.

Habitat:

C. pulchra pulchra apparently lives in depths about 10 to 30 fathoms, though occasional live specimens occur in shallow water along the coast, where they can be found in sand patches, at low tide. *C. pulchra woolacottae* occurs on coral cays; it lives in sand patches, apparently buried or hiding under coral boulders at low tide, but comes out to feed at the turn of the tide, especially towards evening, when it appears with startling suddenness in numbers on sand patches which previously had appeared quite deserted. Young specimens can be found by digging in the sand to a depth of a few inches, but the depth to which the adults burrow is not known. The animals crawl about actively, and because of their bright blotched red coloration are very conspicuous.

Cymbiolacca wisemani (Brazier)

(Pl. xlv, figs. 7 & 8)

Voluta (Aulica) wisemani Brazier, 1870, *P. Zool. Soc. London* 1870: 108.

Voluta (Aulica) wisemani Brazier, 1871, *J. de Conchyl.*, 19: 78-80, pl. 5, fig. 1.

Voluta wisemani Crosse, 1871, *J. de Conchyl.*, 19: 278.

Voluta wisemani Sowerby, 1887, *Thes. Conch.*, 5: 297, pl. 573 (*Voluta* pl. 14), fig. 139.

Cymbiola wisemani Iredale, 1929, *Mem. Queensland Mus.*, 9: 283.

Cymbiola wisemani Allan, 1950, *Australian Shells*, p. 167.

Remarks:

This beautiful species was rarely known until recently. Brazier described the species from "North Queensland," consequently the species was considered to be doubtfully Australian, and Hedley (1909) did not include it in his Queensland List. Iredale (1929) rediscovered the shell at Michaelmas Cay, where it has been found fairly commonly since. Iredale commented that the type was preserved in the Australian Museum, and the specimen here figured in Plate xlv, fig. 7, is marked "Type" in Brazier's handwriting. However, it also bears the locality data Lady Elliott Island in Brazier's script, which does not agree with the original description. Furthermore, the species does not seem to occur at Lady Elliott, so it must be assumed that Brazier added this incorrect locality afterwards. That the specimen is the type is fairly certain on account of Brazier's label and its general agreement with the original figure, which was probably redrawn in France from an original sketch provided by Brazier.

There is a good deal of variation in this species, which has recently attracted the attention of collectors. Michaelmas Cay shells have been accepted as typical, but in fact this population usually lacks the minute dark spots characteristic of the holotype and most other specimens. Specimens from Keeper Reef, near Townsville, Undine and Mackay Reefs, near Cairns, are all more elongate, usually smaller, and with noticeable minute spots, and one of these from Keeper Reef is figured in Plate xlv, fig. 8. These, however, cannot be considered to represent a geographic race, as their range completely overlaps

the area of normal reef populations, and the differences appear to be due to colony formation rather than geographic speciation.

Description:

Shells small to medium sized, the maximum length about 80 mm., the maximum width about 45% to 50% of the maximum length. Spire short to moderately elongate, shells more or less shouldered, the spines variable, small and suppressed in some populations, erect and pointed in others, slightly recurved, but in either case not developed on the outer part of the lip, the last few spines reduced. Ground colour creamish white to pinkish orange, sometimes suffused with a bluish tinge; the whole shell covered with large white patches, roughly triangular, which run together so that the ground colour is almost obliterated; these triangular patches ill defined, often greater than 15 mm. across. Shell circled with two fairly definite bands of orange-brown splashes, cut across by large obscure white patches. The shell usually covered with randomly distributed minute dark-brown spots, a little elongated vertically, sometimes obscured by orange patches; the spots not greater than 1 mm. in length and 0.5 mm. in width. These spots sometimes more obvious between the bands of orange splashes, but usually distributed over the whole shell.

Animal and radula unknown.

Types:

The holotype of *Volva (Aulica) wisemani* is in the Australian Museum, No. C.11497, and is figured on Plate xlv, fig. 9; the type locality is "North Queensland," which can be restricted to between Townsville and Cairns.

Records:

Keeper Reef, near Townsville (A. J. Marsh, P. Goadby, A.M.), Watt Reef, near Townsville (P. Goadby), Michaelmas Cay, near Cairns (A.M., Miss G. Thornley, Mrs. J. A. Grigg, P. Goadby, J. Fearnley), Upolo Banks, near Cairns (A. J. Marsh), Mackay Reef, near Cairns (P. Goadby), Undine Reef, near Cairns (A. J. Marsh), Green Island, near Cairns (T. Garrard, N.M.V.), Outer Barrier Reef, off Cairns (N.M.V.), Euston Reef, near Cairns (P. Goadby), Queensland.

Habitat:

"In one to four feet of water at low spring tides, Michaelmas Cay" (J. Fearnley).

Cymbiolacca perryi (Ostergaard and Summers).

(Pl. xlv, fig. 9)

Aulicina perryi Ostergaard and Summers, 1957, *J. Mal. Soc. Australia*, 1: 30-31, text fig.

Remarks:

This unusual form was found in 1953 at Wistari Reef in the Capricorn Group. The name has been circulated in manuscript for some years but only recently published. Unfortunately the types are all in private collections, but I have been able to examine the two paratypes in Australia, thanks to Messrs. A. Nash and R. Perry, of Gladstone, and have been provided with pictures of the holotype by Mr. Summers. The shells are all juvenile, and the exact taxonomic status of this form cannot be determined until more specimens are available. The locality where they were found is one which abounds in *C. pulchra woolacottae*, so that it is possible that *perryi* is only a colour form of this race. It is also possible that the shells represent a southern occurrence of *C. wisemani*, which resembles *C. perryi* fairly closely in colour pattern, but juvenile shells of *C. wisemani* are not yet available for direct comparison. However, the locality is many miles south of the range of *C. wisemani*, and the shells certainly look distinctive. Finally, it remains possible that *perryi* is a good species, apparently very rare, for intensive collecting has been done in the Capricorn Group for many years. For the time being *C. perryi* is admitted as a full species.

Description:

Shells small, juveniles only known, the maximum length 47 mm., the maximum width about 50-52% of the maximum length. Spire relatively short, body whorl large, shouldered, bearing prominent spines which are erect, outstanding, and extend down the body whorl as short ridges. Shell pinkish-white with two more or less complete bands of orange-brown encircling the shell, one at the base of the spines and one half-way down the body whorl; the shell almost completely lacking in dark spots except for one large spot on the oral surface of the body whorl of one paratype, at the position of the median orange band. The figure of this species (Pl. xlv, fig. 9) is drawn from a Kodachrome transparency of Nash's paratype.

Types:

The holotype is in the collection of Mr. Ray Summers, of Petulama, California, and the paratypes are in the collection of Messrs. Roy Perry and Arthur Nash, of Gladstone, Queensland. The opportunity is here taken of urging the owners of these types to deposit them in some Museum collection at the first opportunity, where they will be preserved for posterity and will not be lost, as has happened so often in the past, leading to yet another insoluble problem of molluscan taxonomy. The type locality is Wistari Reef (not Westaria, as stated in the original description), Capricorn Group, Queensland.

Records: Known only from the types.

Habitat: Unknown.

Origin and Relationships:

These well differentiated species lend themselves to speculation as to their evolutionary origin and relationships with one another. Their precise colour patterns, which though related are fairly clearly defined, may be indicative of their lineage. (The close relationship of the species is exhibited by the changes which take place in the colour patterns after a serious break. Typical *pulchra* often reverts to the *complexa* pattern and to *wisemani* coloration.)

The genus is probably a derivative of the *Aulica* type shell, in view of the similarity in protoconch structure and radular teeth. (However, a similar protoconch to that of *Cymbiolacca* is found in *Notovoluta*, which closely resembles *Cymbiolacca* in form but differs in the development of the columellar plaits and in colour pattern.) It is possible that *Cymbiolacca* arose as a southern isolate of *Aulica* and that *C. complexa complexa*, with its tendency to a simple unornamented shell and randomly distributed spots, may represent the primitive type.

C. wisemani, which retains the randomly distributed spots but has developed an ornate form and background colour, may be a direct derivative from the southern *complexa* through the isolation of a northern stock. *C. pulchra pulchra* suggests itself as a fairly recent derivative of *complexa*, for there is not a great deal of difference between coastal *pulchra* and Queensland *complexa*, the essential difference being the confinement of the dark spots in *pulchra* to definite bands. Just what the past isolating barriers might have been which could have caused these developments cannot be stated. However, it should be remembered that, like all other volutid molluscs, these species probably lay attached egg-capsules, and the young hatch as small versions of the adult in the crawling stage. Thus there is no free swimming larval stage to allow widespread dispersal, so that movement up and down a coastline is probably achieved at a slow rate by the rafting of eggs and young individuals on drifting objects. This means that there is a tendency for colony development with the accumulation of marked differences (well illustrated by the present variation of *C. pulchra woolacottae* in the Capricorn Group) and that any barriers to the free movement of floating objects would act as effective isolating barriers for these molluscs.

From these three basic species the more recently discovered forms have probably arisen in comparatively recent times.

C. complexa nielseni is quite obviously an isolate of the southern *complexa*, confined to Hervey Bay, with Fraser Island preventing much gene flow between the two populations. The coral cay form *C. pulchra woolacottae* today shows much variation, and probably will result in the eventual development of a number of distinct races, some populations already approaching this status. The discovery of true *C. pulchra* in the deeper waters around the Capricorn Group together with a tendency towards the development of intermediate populations as at North-West Islet and Bustard Head suggest that there may have been initial isolation of the island form from the coastal shells, and subsequent re-invasion of the deeper water, with consequent secondary intergradation. On the other hand, it is more likely that *C. p. woolacottae* is an ecological form, adapted to shallow water conditions on coral cays.

C. perryi either represents a recent derivative of *C. wisemani* through southward rafting, or else a colour mutant stock, derived from *C. pulchra*. It may yet prove to be a widespread species.

There does not seem to be any real overlap in range between the three common species, most apparent instances of this proving to be due to misidentifications or inaccurate data. It should be noted that treatment with strong acids of both *C. complexa* and *C. pulchra* produces an orange-brown shell very similar to *C. wisemani*.

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EXPLANATION OF PLATE xlv.

(All figures approximately two-thirds natural size.)

- Fig. 1. *C. complexa complexa* Iredale. N. of Noosa Heads, Queensland. C.62066.
 Fig. 2. *C. complexa complexa*. Off Manning River Heads, N.S.W. C.62308.
 Fig. 3. *C. complexa nielseni* McMichael. Holotype. C.62297.
 Fig. 4. *C. pulchra pulchra* Sowerby. South Keppel Id., Qld. C.62304.
 Fig. 5. *C. pulchra woolacottae* McMichael. Heron Id., Qld. C.62265.
 Fig. 6. *C. pulchra woolacottae*. Holotype. C.62264.
 Fig. 7. *C. wisemani* Brazier. Holotype. C.11497.
 Fig. 8. *C. wisemani* Brazier. Keeper Reef, off Townsville, Qld. C.62310.
 Fig. 9. *C. perryi* Ostergaard & Summers. Paratype. A. J. Nash Collection.